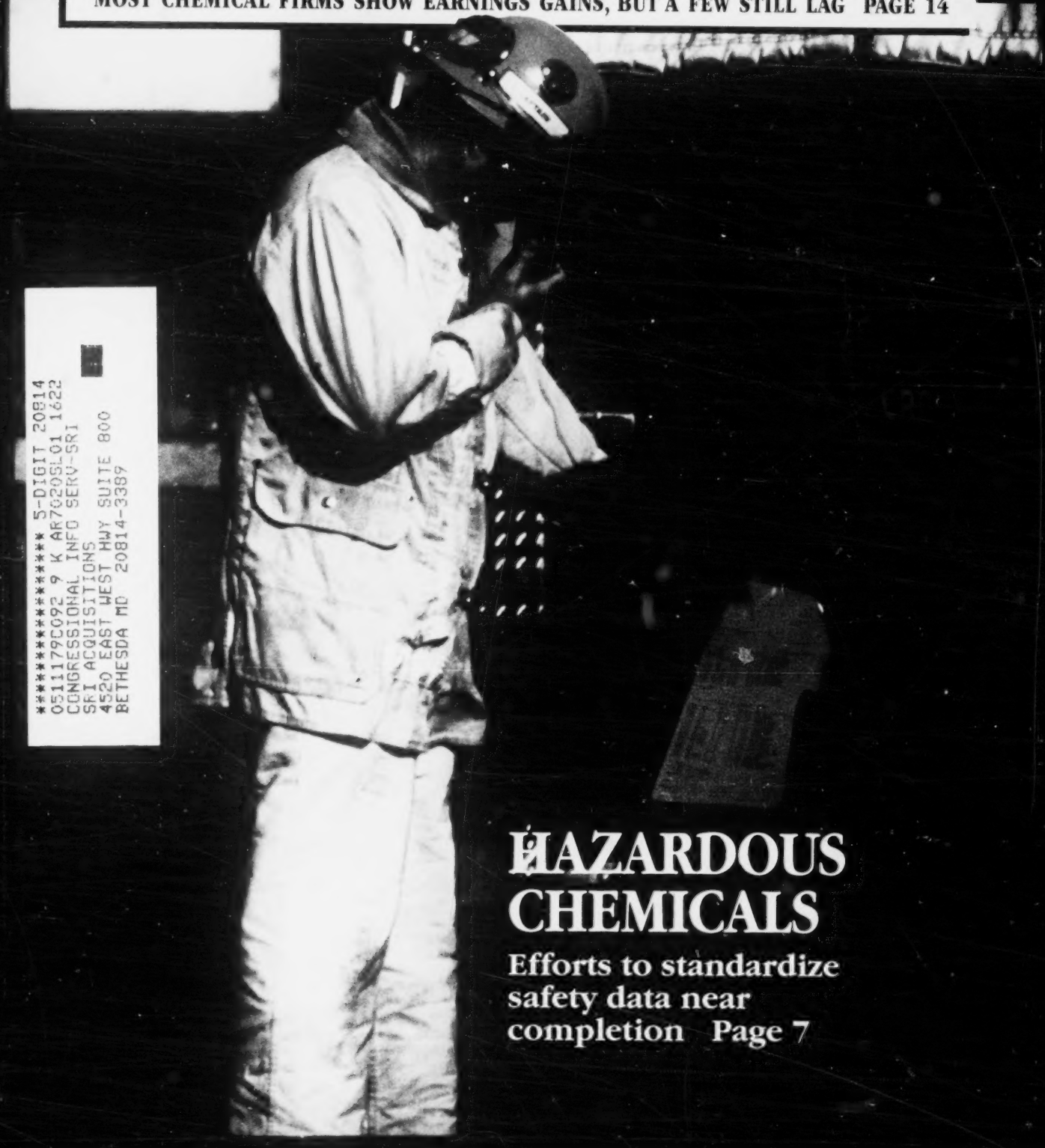
CHEMICAL & ENGINEERING NEWS

C&EN

MAY 18, 1992

MOST CHEMICAL FIRMS SHOW EARNINGS GAINS, BUT A FEW STILL LAG PAGE 14



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HAZARDOUS CHEMICALS

Efforts to standardize safety data near completion Page 7

CHEMICAL & ENGINEERING NEWS

C&EN

MAY 18, 1992

NEWS OF THE WEEK

■ Compromise accord reached by 143 nations on global warming treaty is vague on targets, timetables for reducing carbon dioxide emissions. **Page 4**

■ Two new studies reach vastly different conclusions about the costs of curbing carbon dioxide emissions. **Page 4**

■ In first swaps of emissions allowances for sulfur dioxide, Wisconsin Power & Light announces deal with Pittburgh's Duquesne Light and the Tennessee Valley Authority. **Page 5**

■ Caltech scientists claim isolation of microscopic crystals of the magnetic material magnetite from human brain tissue. **Page 6**

■ Allied-Signal makes biggest investment ever outside U.S. by beginning construction in France of 19,000-metric-ton-per-year plant for making polyester industrial fiber. **Page 6**

COVER: Fireman consults material safety data sheet during an emergency. Photo courtesy of Chemical Manufacturers Association

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BUSINESS

Earnings were up for most major U.S. chemical producers in this year's first quarter. **Page 14**

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World Bank's latest report views economic growth as a vital player in the drive for sustainable development. **Page 19**

PARSONS AWARD

Bradford R. Stanerson, retired ACS staff and board member, will receive ACS's 1993 Charles Lathrop Parsons Award. **Page 21**

SCIENCE/TECHNOLOGY

Uses of cyclodextrins in organic synthesis, food processing, and pollution control are explored at recent symposium. **Page 25**

First polymer to contain buckminsterfullerene, C_{60}, is synthesized in a simple free-radical process. **Page 26**

Arctic ozone levels will decrease within the next decade, according to NASA scientists. **Page 27**

EDUCATION

High-tech chemistry research and teaching center at Boston College features microcomputers and video technology. **Page 29**

ACS NEWS

Committee on Professional Training reports on 1991 bachelor's, master's, and Ph.D. graduates of ACS-approved schools. **Page 30**

Illinois, Cornell, and California-Berkeley graduated most B.S., M.S., and Ph.D. chemists last year. **Page 36**

Fifty-year members being honored this year by local sections and the national society are listed. **Page 37**

NEWS FOCUS

A standard for material safety data sheets is in the offing, following a four-year effort by industry to better define the format and substance of these forms. **Page 7**

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LETTERS

CHEMICAL SAFETY

Oxygen cylinder accident

We wish to report a bizarre and freak accident. We had used an oxygen cylinder (in a vertical position), reducing its pressure from 3000 psi to about 1500 psi over several weeks. One morning when the main valve of the cylinder (to which a high-pressure regulator was attached) was opened by a counterclockwise turn of 15° to 30°, the valve flew off the cylinder vertically and lodged in a light fixture in the ceiling, allowing the oxygen to escape from the cylinder during a 10-minute period. The threads in the valve indicated that they were stripped, and the Kel-F seat could not be found. The rupture disc on the cylinder was intact. Injury consisted of two badly bruised fingers.

Did the Kel-F ignite? Was the valve thread previously damaged? These questions have yet to be answered. Has this type of accident occurred previously? Our concern is that what happened once may occur again and possibly with other gases.

H. D. Gesser
S. S. Shepelev
Department of Chemistry
University of Manitoba, Winnipeg

Public relations champion

I was saddened to read of the separation of Alfred Bader from Sigma-Aldrich (C&EN, April 6, page 39). In many regards, Bader and Aldrich Chemical are one and the same to many practitioners of organic chemistry.

Thirty some years ago, when I was a fledgling chemist and Aldrich was a fledgling chemical supplier, Bader came to my laboratory to extol the virtues of chemicals supplied by Aldrich. He was also interested in learning how Aldrich could be improved, what they could do for organic chemists, and what reagents they could make that they were not making. In terms of Bader's efforts during the past 30 years, little has changed. He has been a super salesman for Aldrich Chemical and a good friend of organic chemists throughout the world. There is no doubt in my mind that the phenomenal growth of Aldrich was overwhelmingly the result of Bader's efforts. As a consummate organic chemist, Bader was never too busy to talk about organic chemistry. He was always willing to listen to suggestions on ways in which Aldrich might improve its current product line. His visits to my laboratory over the years were always welcomed because I knew that he not only had the best interest of Aldrich at heart, but that he also had the best interest of the bench chemist at heart.

Although I am sure that all of the details and reasons for what would appear to be an unwarranted separation of Bader from Aldrich Chemical will never be available to the casual observer, I am equally sure that Sigma-Aldrich and Bader will both suffer from this dismissal. Public relations is a serious business. Perhaps corporate America should think more carefully before discarding its public relations champions.

Paul G. Gassman
Regents' Professor of Chemistry
University of Minnesota, Minneapolis

Silver-coated beads

There has been a news story in several local papers about Mark Pollock, Solano County (California) District Attorney, and his suit to take the silver-coated beads for cake and cookie decoration off the shelves of bakeries and grocery stores. His basis was the heavy metal toxicity of the silver coating. The three manufacturers of such confections decided not to contest, and withdrew their products. I can understand that, as their sales in a rural county don't profit enough to support the legal fees for at least a millennium.

My instant response was, "How California!"—a comment not pleasing to natives or long-time residents. But then I thought

Correction

- March 9, page 14: The NIH Office of Research on Women's Health workshop will be held June 11–12 at the Bethesda Marriott, not June 12–13 at NIH.

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Signs of Recovery for Chemical Earnings Despite Overall Decrease

■ ***First-quarter results for U.S. chemical companies declined on average, but are distorted by big drop in profits for Dow Chemical***

William J. Storck,
C&EN Northeast News Bureau

The chemical industry finally may be springing to life. Granted, chemical earnings as a whole were down for a group of 30 major U.S. chemical companies in this year's first quarter, but the results were largely skewed by one company—Dow Chemical. Excluding Dow, combined earnings for the group increased more than 10% over the comparable period last year.

And of the 30 companies surveyed by C&EN, only six showed deficits or earnings declines. This is a slight improvement from last year's fourth quarter, when seven of the 30 companies reported declines or deficits. Not only were most chemical companies' earnings up in the first quarter, but a few set earnings records.

For the 30 chemical firms regularly surveyed, first-quarter earnings declined 7% from the year-earlier period to almost $1.20 billion. This represents 11 straight quarters of overall earnings declines for the group. Sales fell 1% in the quarter to almost $20.9 billion. As a result, the aggregate profit margin for the group fell to 5.7% from 6.1% in first-quarter 1991.

However, Dow, with a 53%, or $194 million, decline in earnings, was by far the deciding factor in the overall decline, representing a big chunk of earnings dollars for the other companies to offset. Excluding Dow from the quarterly figures, the remaining 29 companies posted total earnings of $1.03 billion, up 11% from the same quarter last year on relatively unchanged sales of $16.3 billion. And profitability at these 29 companies rose to 6.3% from 5.7%.

If all six of the companies with losses or earnings declines in the first quarter are excluded, combined earnings for the remaining 24 rose 26% to $803 million on a 5% sales gain to $10.7 billion. And the profit margin for the group rose to a very healthy 7.5% from 6.3% in first-quarter 1991.

But even leaving Dow's results in the total provides some hope for recovery during the remainder of this year. The total earnings for the 30 companies in the first quarter were up 46% from the fourth quarter of 1991 on a 2% rise in sales. And the profit margin for the group rose to 5.7% from 4.0% in last year's fourth quarter. Even discounting seasonal variations, a 46% quarter-to-quarter earnings increase is considered good.

For other chemical producers, overall earnings in the first quarter were mixed—down substantially for oil companies but up for both diversified companies and pharmaceutical manufacturers. For 13 oil companies that produce chemicals, for instance, earnings fell a combined 54% to $2.30 billion on a 15% decline in sales to $86.2 billion. Profit margin for the group slipped to 2.7% from 4.9% in last year's first quarter.

For 11 companies that can only be classified as "diversified and other," earnings rose 6% to a combined $1.25 billion as sales fell 1% to about $27 billion. This raised the profit margin for the group to 4.6% in the first quarter from 4.3% a year earlier.

Pharmaceutical companies with their noncyclical products showed the best results. Ten drug companies surveyed posted a combined earnings increase of 14% to $3.19 billion as sales rose 8% to

Chemical industry leaders for first-quarter 1992

Sales

Rank 1992		$ Millions	Rank 1991
1	Dow Chemical	$4639.0	1
2	Monsanto	2188.0	2
3	American Cyanamid	1378.6	5
4	W. R. Grace	1325.9	3
5	Union Carbide	1187.0	4
6	Air Products	793.3	7
7	Arco Chemical	762.0	9
8	Hercules	744.0	6
9	Rohm & Haas	714.4	10
10	Ethyl	681.6	11

Earnings[a]

	$ Millions	Rank 1991
Dow Chemical	$171.0	1
Monsanto	161.0	2
American Cyanamid	114.8	3
Air Products	73.3	4
Arco Chemical	61.0	21
Rohm & Haas	59.3	8
Great Lakes Chemical	53.0	10
Ethyl	52.2	6
International Flavors	50.6	7
Lubrizol	44.1	11

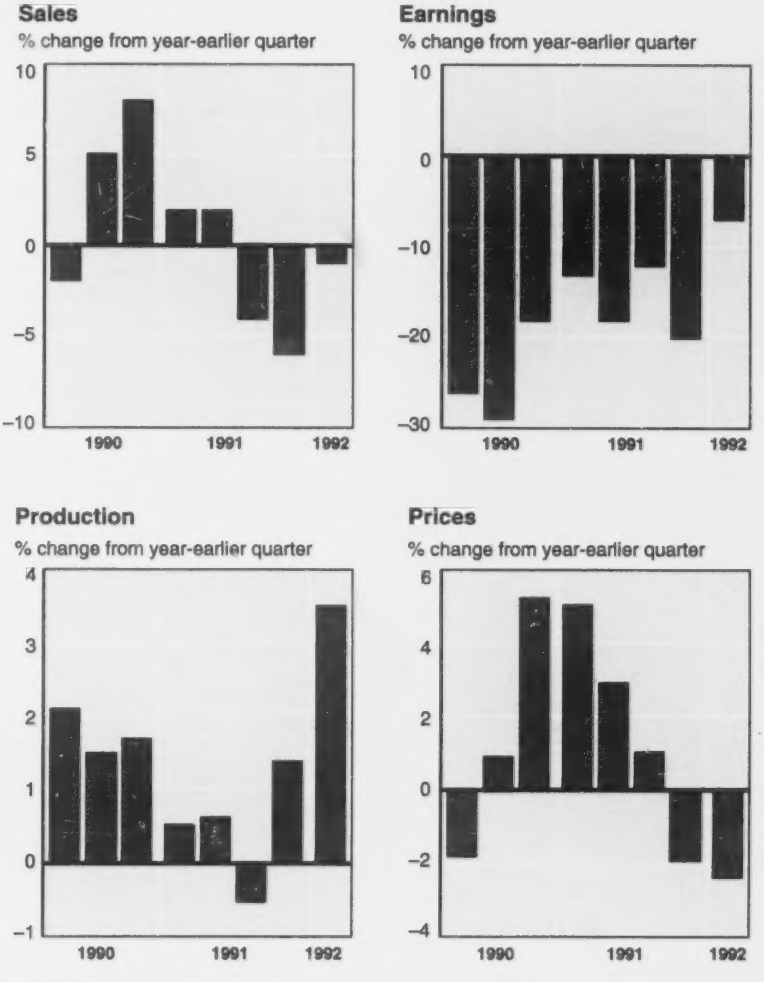
Profitability

	Earnings as a % of sales	Rank 1991
International Flavors	17.8%	1
Great Lakes Chemical	15.0	2
Loctite	13.3	4
Betz Laboratories	11.4	5
Lubrizol	10.6	6
Nalco Chemical	10.1	2
Air Products	9.2	7
Crompton & Knowles	8.7	10
American Cyanamid	8.3	8
Rohm & Haas	8.3	17

Note: Based on 30 chemical companies listed on page 16. **a** After taxes.

Chemical industry 1992 first-quarter results

- **Sales slipped 1%**
- **Earnings fell 7%**
- **Profitability was 5.7%**
- **Production rose 3.5%**
- **Prices fell 2.4%**



Note: All sales, earnings, and profit-margin data are based on 30 chemical companies listed on page 16.

$17.7 billion. This raised profitability for the group to 18% in the first quarter from 17% in the same period of 1991.

Not only are the financial performances of many chemical producers showing improvement, but also overall chemical economic data are beginning to improve. For instance, the Commerce Department reports that shipments of chemicals and allied products in the first quarter totaled slightly less than $73 billion, up almost 5% from the first quarter of 1991. This increased demand led seasonally adjusted production of chemicals to grow 3.5% in this year's first quarter over the comparable period a year earlier. And chemical capacity utilization has increased slightly to a seasonally adjusted 79.4% in this year's first quarter from 78.8% in the same period last year.

Within the total chemicals segment, however, industrial chemicals are lagging as would be expected since they are the most cyclical part of the industry. For instance, shipments of industrial chemicals in the first quarter totaled about $37.1 billion, down less than 1% from the year-earlier period.

Chemical pricing also remains soft. The average producer price index for chemicals and allied products in the first quarter this year was still down 2.4% from the comparable quarter last year.

In a sense, though, price comparisons for many chemical products as a sign of economic activity during the first quarter are probably not very reliable because of increases in the first quarter last year as a result of instability in the Middle East. Dow was one company hit hard by this factor. The company points out that its sales in first-quarter 1991 were the company's second highest. Frank P. Popoff, Dow's president and chief executive officer, says, "Because of the rapid escalation of prices during the Gulf War, comparisons to that quarter are very difficult." Dow's prices in this year's first quarter were down 11% from a year earlier and robbed the firm of $588 million. Popoff says, however, "The good news is that pricing has become relatively stable over the past six months, feedstock costs have declined,

Earnings improved for most chemical companies in first quarter

	FIRST-QUARTER 1992						12-MONTH RUNNING DATA			
	Sales	Earnings[a]	Change from 1991		Profit margin[b]		Change from 1991		Profit margin[b]	
	($ millions)		Sales	Earnings	1992	1991	Sales	Earnings	1992	1991
Air Products	$ 793.3	$ 73.3	5%	11%	9.2%	8.7%	0%	7%	8.4%	7.8%
American Cyanamid	1,378.6	114.8	5	10	8.3	8.0	11	15	7.0	6.8
Arco Chemical	762.0	61.0	12	259	8.0	2.5	3	−34	5.5	8.6
Betz Laboratories	175.7	20.1	8	10	11.4	11.2	10	13	11.4	11.1
Cabot	417.9	22.0	2	41	5.3	3.8	−11	−19	3.3	3.7
Crompton & Knowles	113.6	9.9	7	21	8.7	7.7	14	20	8.2	7.8
Dow Chemical	4,639.0	171.0	−6	−53	3.7	7.3	−7	−40	4.2	6.5
Ethyl	681.6	52.2	4	5	7.7	7.6	2	−6	8.1	8.8
First Mississippi	122.8	2.3	−6	28	1.9	1.4	3	81	1.8	1.0
H. B. Fuller	218.8	6.0	8	65	2.8	1.8	7	22	3.5	3.0
Georgia Gulf	189.6	13.0	−19	−24	6.8	7.3	−13	−38	7.2	10.2
B. F. Goodrich	605.3	0.1	5	def	0	def	3	−87	0.5	4.0
W. R. Grace	1,325.9	19.0	−10	−41	1.4	2.2	−9	2	3.3	2.9
Great Lakes Chemical	354.6	53.0	7	37	15.0	11.7	19	18	12.8	12.8
Hercules	744.0	36.9	−3	14	5.0	4.2	−9	22	4.9	3.7
IMC Fertilizer	267.5	20.3	−7	9	7.5	6.5	−5	2	8.5	8.0
Imcera Group	433.5	32.6	6	20	7.5	6.7	7	24	6.6	5.7
International Flavors	284.1	50.6	5	8	17.8	17.4	4	6	16.7	16.4
Loctite	147.5	19.7	7	24	13.3	11.4	−6	5	13.3	11.9
Lubrizol	414.9	44.1	11	25	10.6	9.5	3	−4	8.8	9.5
Monsanto	2,188.0	161.0	−2	−3	7.4	7.5	−1	24	7.0	5.6
Morton International	555.0	41.2	7	2	7.4	7.8	7	7	7.2	7.2
Nalco Chemical	326.4	33.0	22	6	10.1	11.7	13	5	10.3	11.0
Olin	614.2	23.6	9	11	3.8	3.8	−8	−3	3.0	2.9
Petrolite	79.9	4.3	3	54	5.4	3.6	7	32	5.0	4.0
Quantum Chemical	631.3	−12.1	−15	def	def	2.6	−11	def	def	1.3
Rohm & Haas	714.4	59.3	5	44	8.3	6.1	0	−7	6.5	6.9
Stepan	107.4	4.1	5	69	3.8	2.4	6	6	3.4	3.4
Union Carbide[c]	1,187.0	44.0	−10	−21	3.7	4.2	−10	−83	0.7	3.7
Witco	420.3	18.9	6	13	4.5	4.2	1	16	4.6	4.0
TOTAL	$20,894.2	$1199.2	−1%	−7%	5.7%	6.1%	2%	−15%	5.5%	6.6%

a After-tax earnings from continuing operations, excluding significant nonrecurring and extraordinary items. b After-tax earnings as a percentage of sales. c Excludes results from industrial gases, now carried as a discontinued business. **def** = deficit

and we have probably reached the bottom of the economic cycle in the U.S."

Of course, it was commodities that hurt Dow. Operating income for its plastics unit was down 56% from a year ago as was operating income for chemicals and performance products, where the drop was led by chlorinated solvents and softer demand for caustic soda. Its hydrocarbons and energy business had an operating loss of $30 million, compared with an operating income of $25 million in first-quarter 1991. Operating income for consumer specialties grew 17%.

Soft pricing also hurt chemical operations at oil companies. Chemical net earnings at a group of nine oil companies declined a combined 47%. Commenting on Mobil's chemical earnings, which plummeted 89% to just $10 million, chairman Allen E. Murray says, "Earnings were hurt as both U.S. and foreign petrochemical margins receded from last year's levels when strong consumer demand was experienced." He also says that this year's margins were weakened as new industry capacity came on stream.

Shell Oil, whose chemical earnings dropped 45%, says, "Chemical sales volumes increased, reflecting higher demand across most product lines. This resulted in improved performances in downstream chemical businesses. However, earnings in commodity chemicals declined as a result of depressed selling prices due to industry overcapacity."

Despite the lower chemical earnings for oil companies and the six chemical firms—most of which are tied to commodities—it was a good quarter for many other chemical companies—those with more than 50% of their sales in chemicals. In fact, even with the recession, two of the chemical firms set records—Great Lakes Chemical and Lubrizol. Great Lakes Chemical, whose first-quarter earnings grew 37% to $53 million for an all-time quarterly company record, completed the acquisition of Octel Associates, boosting the firm's earnings. Emerson Kampen, the company's chairman, says, "Clearly, Octel Associates played a significant part in the quarter's success." But he is also quick to credit the company's flame-retardant business and its Bio-Lab unit, a supplier of chemicals for swimming pools and spas. Kampen adds, "We

Earnings rise at diversified and drug companies, but plummet at oil firms

	FIRST-QUARTER 1992					
	Sales	Earnings[a]	Change from 1991		Profit margin[b]	
	($ millions)		Sales	Earnings	1992	1991
OIL AND GAS COMPANIES						
Amoco	$ 6,384.0	$ 234.0	−13%	−52%	3.7%	6.7%
Ashland	2,242.3	−9.1	5	def	def	1.2
Chevron	9,700.0	217.0	−10	−63	2.2	5.4
Exxon	27,914.0	1350.0	−9	−40	4.8	7.3
American Petrofina	661.0	−5.5	−19	def	def	1.0
Kerr-McGee	782.7	8.6	0	−71	1.1	3.8
Mobil	15,151.0	213.0	−9	−70	1.4	4.3
Occidental Petroleum	2,154.0	21.0	−22	−76	1.0	3.2
Phillips Petroleum	2,759.0	−26.0	−68	def	def	1.7
Shell Oil	4,990.0	91.0	−12	−27	1.8	2.2
Sun Co.	2,530.0	−13.0	−15	def	def	1.7
Texaco	8,560.0	200.0	−16	−52	2.3	4.1
Unocal	2,421.0	23.0	−11	−62	1.0	2.2
TOTAL	$86,249.0	$2304.0	−15%	−54%	2.7%	4.9%
DIVERSIFIED MANUFACTURERS						
Allied-Signal	$ 2,979.0	$ 127.0	3%	102%	4.3%	2.2%
Du Pont	9,185.0	482.0	−5	−18	5.2	6.1
Eastman Kodak	4,410.0	145.0	0	−19	3.3	4.0
Engelhard	630.0	23.8	0	13	3.8	3.4
FMC	933.9	54.7	6	41	5.9	4.4
Ferro Corp.	272.6	12.9	4	350	4.7	1.1
3M	3,406.0	288.0	1	−4	8.5	8.9
NL Industries	226.1	−4.4	0	def	def	def
PPG Industries	1,446.7	78.8	5	260	5.4	1.6
Tenneco[c]	3,272.0	33.0	−2	3200	1.0	0
Vulcan Materials	210.6	4.6	7	def	2.2	def
TOTAL	$26,972.0	$1245.5	−1%	6%	4.6%	4.3%
PHARMACEUTICAL COMPANIES						
Abbott Laboratories	$ 1,877.9	$ 294.2	14%	16%	15.7%	15.4%
American Home Products	1,998.5	406.3	13	15	20.3	20.0
Baxter International	2,296.0	131.0	8	19	5.7	5.2
Bristol-Myers Squibb	2,783.4	547.5	2	11	19.7	18.0
Eli Lilly	1,557.1	442.6	8	14	28.4	27.1
Merck	2,223.4	568.7	9	18	25.6	23.6
Pfizer	1,761.3	295.1	4	10	16.8	15.8
Schering-Plough	1,021.9	192.9	8	11	18.9	18.2
Upjohn	871.9	143.7	9	8	16.5	16.7
Warner Lambert	1,311.5	163.6	8	17	12.5	11.5
TOTAL	$17,702.9	$3185.7	8%	14%	18.0%	17.0%

a After-tax earnings from continuing operations, excluding significant nonrecurring and extraordinary items. **b** After-tax earnings as a percentage of sales. **c** Includes special item. **def** = deficit.

have started the year at a record-setting pace, with quarterly results well ahead of any mark in company history. This accomplishment affirms Great Lakes' fundamental growth strategies. What's more, I'm convinced that as the year unfolds, we have the means to accelerate our progress on many fronts, including new fuel additives, high-value-added specialty chemicals, select acquisitions, and strategic alliances."

Lubrizol's first-quarter earnings jumped 25% to $44.1 million, setting a company record for any year's first quarter. Company chairman L. E. Coleman says: "We are very pleased with the strength in our specialty chemicals business, which improved during the second half of 1991 and is growing as planned. Additive shipments increased 25% when compared to the weak first quarter of 1991 and are continuing at the same high levels achieved during the third and fourth quarter last year. ... We expect to maintain these shipment levels throughout 1992 and expect to match or exceed our historic unit volume growth rate."

For the remainder of the year, chemical executives appear cautiously optimistic as the economy embarks on what seems to be a slow expansion, but they are certainly not ready to commit to ebullience. At Rohm & Haas, chairman and chief executive officer J. Lawrence Wilson says, "The economic climate has improved since the first of the year. If this improvement continues, Rohm & Haas stands ready to take advantage of the higher level of business."

Dow's Popoff says: "Although there are some encouraging signs of recovery from the recession in the U.S., the European economies have weakened and Pacific markets, particularly Japan, have moderated their growth. While the chemical industry tends to lag any upward economic movement by as much as six months, we continue to be optimistic about having positive earnings momentum during the second half of 1992."

At B. F. Goodrich, which showed a small profit in the first quarter after a loss in the same period last year, chairman John D. Ong says, "Demand for many of our specialty chemical products is improving and our aerospace business again reports strong results. If economic conditions continue to strengthen, we would expect to see significant growth in earnings in the quarters ahead."

Probably the most cautious forecast by any chemical company executive was made by Alan R. Hirsig, president and chief executive officer of Arco Chemical. Although the company showed the highest year-to-year growth in earnings of any company on the list at 259%, Hirsig says, "we have not as yet seen the volume growth necessary to indicate a sustained recovery is under way." Hirsig places more credit for the company's good results on lower feedstock costs and the company's cost reduction program that was implemented in the second half of 1991 than he does on economic expansion. □

ACS Committee on Professional Training 1991 Annual Report

The number of bachelor's degree graduates in chemistry from colleges and universities whose undergraduate chemistry programs are approved by the American Chemical Society increased 2.9% in the 1990–91 academic year. This reverses the downward trend for the first time since 1983. The number of master's degrees from these departments dropped less than one half a percentage point. This is the second drop in a row. The number of Ph.D. degrees continued to increase for the 13th year in a row. However, the increase of 3.8% was less than half of last year's gain.

The percentage of baccalaureate graduates certified to ACS was 42%. This number has remained fairly constant over the years. (Certified graduates are those who have completed a curriculum that meets the guidelines specified by ACS and who are eligible for full membership in ACS; noncertified graduates may become associate members of ACS upon graduation and full members after three years of professional experience or a higher degree in a chemical science.)

Total numbers of bachelor's degrees (certified and noncertified), master's degrees, and Ph.D. degrees awarded in 1990–91 by departments whose undergraduate chemistry programs are ACS approved are listed by institution in the large table at the end of this report and are summarized in the two smaller tables. These tables also include numbers of chemical engineering graduates from institutions whose programs are accredited by the American Institute of Chemical Engineers and the Accreditation Board for Engineering & Technology. (Note: These departments are not required to report their data to CPT, so the number of departments included varies each year.) Included for the fifth year is a table with information on graduate student enrollments in chemistry departments whose undergraduate programs are ACS approved.

Summary of data from departments offering an ACS-approved program, 1987-91

	Bachelors				Masters		Doctorates	
	Number of schools	Graduates (totals)	Certified graduates[a]	Noncertified graduates	Number of schools	Graduates	Number of schools	Graduates
CHEMISTRY								
1987	582	8848	3663	5185	316	1636	188	1936
1988	584	8372	3453	4919	319	1584	192	1955
1989	593	8125	3384	4741	318	1710	189	1970
1990	599	7650	3213	4437	317	1605	187	2131
1991	599	7872	3310	4562	316	1600	189	2213
CHEMICAL ENGINEERING[b]								
1987	107	4435	4435	—	103	1078	90	533
1988	128	3524	3524	—	124	1036	106	603
1989	115	2891	2981	—	113	919	95	574
1990	126	3170	3170	—	122	956	106	583
1991	120	3081	3081	—	115	816	104	602

a Includes graduates certified in approved options. b Chemical engineering departments are not required to report their data to CPT, so the number of departments included in this category varies from year to year.

The number of bachelor's degrees in chemical engineering from the 120 AIChE-ABET-accredited departments that reported in 1991 decreased 2.8% after the 9.6% increase reported by 126 departments in 1990. At the graduate level, the number of chemical engineering master's degrees decreased by 15% after an increase of 4% last year. Ph.D. degrees showed a slight increase of 3% for the second year in a row.

The chemistry programs at ACS-approved schools normally are reevaluated at five-year intervals. There were 599 colleges and universities on the approved list at the end of 1991. During the year the committee studied the reports of 290 chemistry programs at approved schools and 15 reports from schools applying for ACS approval. Each evaluation included a review of extensive documentary materials submitted by the department chairman describing the current status of the program.

Three schools were added to the ACS-approved list by CPT; two were put on probation; three were removed from probation; and three were removed from the list. Visiting associates of the committee made on-site visits to 11 schools.

Currently, students may receive certified degrees in chemistry with options in biochemistry, polymers, chemistry education, chemical physics, or materials. By the end of 1991, the com-

Summary of totals from 1991 reports from departments offering ACS-approved program

	Schools reporting	Men	Women	Total
CHEMISTRY				
Bachelors, Total	599	4740	3132	7872
Certified	—	2050	1260	3310
Noncertified	—	2690	1872	4562
Masters	316	952	648	1600
Doctorates	189	1669	544	2213
CHEMICAL ENGINEERING				
Bachelors, Certified	120	2108	973	3081
Masters	115	656	160	816
Doctorates	104	524	78	602

mittee had approved 39 programs with a biochemistry option; five with a polymers option; and one chemistry education option.

After consultation with many constituencies, the committee produced a revised set of appendixes to the "ACS Guidelines & Evaluation Procedures for Undergraduate Professional Education in Chemistry." This appendix material contains course suggestions for analytical, biochemistry, chemical information, materials, polymers, inorganic, organic, and physical chemistry courses as well as guidelines for preparing a research report. Copies of the appendixes are available from the Office of Professional Training, American Chemical Society, 1155—16th St., N.W., Washington, D.C. 20036.

The committee initiated a revision of the ACS guidelines to incorporate requirements for certification of students with a degree in chemistry with an emphasis in biochemistry, polymers, chemistry education, materials, or chemical physics. Also, the committee reviewed information on the library requirements for an ACS-approved program. In order to have the guidelines reflect the best approach in this area, the committee requested input from representatives of the ACS Chemical Information Division and surveyed selected ACS-approved schools regarding library journal holdings and accessibility of electronic information. Based on information gathered, the committee has determined that when a school is unable to maintain a subscription to the print edition of *Chemical Abstracts*, but maintains on-line access, it is very important that there be an adequate budget allowance for on-line searching and that some printed copies of the abstracts and indexes be available to students so they can learn the structure and content of the abstracts and indexes to be able to formulate on-line search requests. Other changes in the library requirements of the guidelines will be included in the 1992 report.

In October 1991, CPT published the 19th edition of the "ACS Directory of Graduate Research." This edition provides information on graduate programs in chemistry, chemical engineering, biochemistry, medicinal-pharmaceutical chemistry, clinical chemistry, and polymer science in 699 academic departments. The committee also formulated a policy by which new sections may be added to future editions of the directory. Possible new sections for the 1993 edition include: toxicology, food science, environmental science, and forensic science.

Other activities of the committee included revising the CPT annual report forms to include data on student ethnicity; publishing the proceedings of the symposium on Innovative Approaches to Teaching Introductory Chemistry; and meeting with the visiting associates of the committee to update them on the core curriculum and optional degrees. The committee also was represented on the ACS Task Force on the Professional Status of Chemical Education; members participated in a Sigma Xi symposium on entry-level undergraduate courses in science; and presented papers at the Joint CPT-SOCED Chemistry Education Symposium.

The committee would like to acknowledge and thank the following visiting associates of the committee who conducted on-site visits to schools on the approved list or applying for ACS approval during 1991: C. A. Arrington Jr., Furman University; Charles P. Casey, University of Wisconsin, Madison; Marcetta Darensbourg, Texas A&M University; Natalie Foster, Lehigh University; John B. Grutzner, Purdue University; William Jones, University of Florida; Heinz F. Koch, Ithaca College; J. C. Martin, Vanderbilt University; Robert F. Pasternak, Swarthmore University; Hans Veening, Bucknell University; Thomas Wartik, Pennsylvania State University.

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Graduate student enrollments in departments whose undergraduate chemistry programs are ACS approved

	Number of departments	First-year graduate students		All graduate students	
		Full-time	Part-time	Full-time	Part-time
M.S. DEPARTMENTS[a]					
Fall 1986	128	474	264	1,190	1051
Fall 1987	127	406	315	1,136	993
Fall 1988	127	420	218	998	855
Fall 1989	130	429	238	1,013	834
Fall 1990	125	511	268	1,244	887
Ph.D. DEPARTMENTS					
Fall 1986	187	3475	235	14,438	1355
Fall 1987	192	3441	201	15,212	1231
Fall 1988	189	3320	171	15,125	1111
Fall 1989	187	3464	159	15,222	1207
Fall 1990	189	3535	256	15,470	1148

a Departments whose highest offering is the master's degree in chemistry

Chemistry and chemical engineering degrees awarded by schools offering an ACS-approved program, 1990-91

	CHEMISTRY				CHEMICAL ENGINEERING		
	Bachelors certified						
	Yes	No	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
Abilene Christian U	6	5	0	—			
Adelphi U	0	2	7	—			
Agnes Scott C	2	1	—	—			
Akron, U of	22	5	2	14	a		
Alabama, U of							
Birmingham	2	0	2	0			
Huntsville	5	5	7	—	a		
Tuscaloosa	6	10	2	7	16	3	0
Alaska Fairbanks, U of	2	6	3	—			
Albion C	4	9	—	—			
Albright C	0	8	—	—			
Alfred U	2	0	—	—			
Allegheny C	0	15	—	—			
Alma C	6	3	—	—			
American U	3	0	2	3			
Amherst C	2	7	—	—			
Andrews U	4	0	—	—			
Appalachian State U	5	7	3	—			
Arizona State U	9	14	2	17	a		
Arizona, U of	17	8	10	28	11	2	4
Arkansas State U	1	4	—	—			
Arkansas Tech U	4	1	—	—			
Arkansas, U of							
Fayetteville	8	4	0	6	36	9	0
Little Rock	2	4	2	—			
Ashland U	0	2	—	—			
Auburn U	7	7	5	6	32	12	5
Augsburg C	4	6	—	—			
Augustana C							
Illinois	0	8	—	—			
South Dakota	2	8	—	—			
Austin C	0	8	—	—			
Austin Peay State U	0	9	—	—			
Baldwin-Wallace C	1	10	—	—			
Ball State U	9	7	3	—			
Barnard C	0	11	—	—			
Bates C	5	2	—	—			
Baylor U	3	17	3	5			
Beloit C	4	11	—	—			
Bemidji State U	5	3	—	—			
Birmingham-Southern C	0	7	—	—			
Bloomsburg U	4	4	—	—			
Boston C	3	2	4	8			
Boston U	8	9	4	8			
Bowdoin C	1	18	—	—			
Bowling Green State U	5	7	4	0			
Bradley U	1	16	0	—			
Brandeis U	0	7	6	7			
Bridgeport, U of	3	0	3	—			
Bridgewater State C	1	4	0	—			
Brigham Young U	15	12	5	11	25	7	4
Brown U	0	3	6	14	4	2	2
Bryn Mawr C	14	0	3	1			
Bucknell U	13	12	3	—	15	2	—
Butler U	2	9	2	—			
California Institute of Tech	4	2	2	21	10	13	11
California Polytechnic State U	10	27	3	—			
California State Poly U	4	3	7	—	a		
California State U							
Bakersfield	1	6	—	—			
Chico	0	13	—	—			
Dominguez Hills	3	1	—	—			
Fresno	8	13	6	—			
Fullerton	5	28	4	—			
Hayward	5	10	5	—			
Long Beach	9	25	13	—	a		
Los Angeles	6	5	2	—			
Northridge	8	14	7	—			
Sacramento	9	5	6	—			
San Bernardino	2	5	—	—			
Stanislaus	0	1	—	—			
California, U of							
Berkeley	28	26	10	55	48	7	19
Davis	33	9	3	31	34	10	3
Irvine	7	30	17	12			
Los Angeles	8	95	15	37	31	9	4
Riverside	13	0	11	10			
San Diego	56	0	15	26	15	1	1
Santa Barbara	0	21	4	18	18	9	5
Santa Cruz	5	15	6	11			

	CHEMISTRY				CHEMICAL ENGINEERING		
	Bachelors certified						
	Yes	No	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
Calvin C	3	1	—	—			
Canisius C	7	5	—	—			
Capital U	2	1	—	—			
Carleton C	6	24	—	—			
Carnegie Mellon U	11	1	6	8	40	7	10
Carroll C	4	2	—	—			
Carthage C	3	4	—	—			
Case Western Reserve U	6	23	6	14	20	10	5
Catholic U of America	3	1	5	6			
Centenary C of Louisiana	0	1	—	—			
Central Connecticut State U	3	1	0				
Central Florida, U of	12	0	5	—			
Central Michigan U	6	15	8	—			
Central Oklahoma, U of	4	7	—	—			
Central State U	1	1	—	—			
Central U of Iowa	0	7	—	—			
Centre C	2	6	—	—			
Charleston, C of	4	13	—	—			
Chatham C	0	0	—	—			
Chestnut Hill C	0	2	—	—			
Chicago State U	0	9	—	—			
Chicago, U of	12	18	13	23			
Christian Brothers C[b]					a		
Cincinnati, U of	21	0	19	29	48	9	8
Citadel, The	1	3	—	—			
City U of New York							
Graduate Center	—	—	—	42			
Brooklyn C	1	15	9	—			
City C	2	3	19	—	a		
Herbert H. Lehman C	7	2	—	—			
Hunter C	0	8	—	—			
Queens C	0	0	9	—			
Clarion U	0	4	—	—			
Clark U	7	2	6	6			
Clarkson U	11	2	13	8	41	11	7
Clemson U	3	14	5	11	29	9	2
Cleveland State U	11	0	7	6	12	1	2
Coe C	1	2	—	—			
Colby C	1	8	—	—			
Colgate U	7	2	—	—			
Colorado C	6	4	—	—			
Colorado School of Mines	10	0	4	6	37	6	3
Colorado State U	7	11	2	23	22	8	1
Colorado, U of							
Boulder	5	43	7	19	27	5	8
Colorado Springs	2	8	—	—			
Denver	7	3	2	—			
Columbia U	4	12	16	20	21	9	2
Concordia C	2	5	—	—			
Connecticut C	3	1	—	—			
Connecticut, U of	13	8	10	12	14	7	4
Cooper Union[b]					a		
Cornell C	0	3	—	—			
Cornell U	18	27	33	19	21	3	4
Creighton U	9	9	—	—			
Dartmouth C	0	14	1	7			
David Lipscomb U	0	20	—	—			
Davidson C	4	2	—	—			
Dayton, U of	6	10	—	—	27	3	—
De Paul U	9	0	8	—			
DePauw U	0	9	—	—			
Delaware State C	1	5	4	—			
Delaware Valley C of Science & Agriculture	4	0	—	—			
Delaware, U of	26	15	3	10	26	4	13
Delta State U	2	7	—	—			
Denison U	0	3	—	—			
Denver, U of	2	5	2	1			
Detroit Mercy, U of	4	6	11	1	a		
District of Columbia, U of the	3	2	—	—			
Dickinson C	0	9	—	—			
Drake U	4	2	—	—			
Drew U	3	3	—	—			
Drexel U	7	0	7	4	41	4	2
Duke U	14	20	2	10			
Duquesne U	0	8	4	1			
Earlham C	1	7	—	—			
East Carolina U	9	8	3	—			
East Stroudsburg U	4	9	1	—			
East Tennessee State U	4	3	2	—			

	CHEMISTRY				CHEMICAL ENGINEERING		
	Bachelors certified						
	Yes	No	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
East Texas State U	1	5	2	—			
Eastern Illinois U	3	3	1	—			
Eastern Kentucky U	3	9	2	—			
Eastern Michigan U	6	16	8	—			
Eastern New Mexico U	1	3	2	—			
Eckerd C	4	0	—	—			
Elizabethtown C	0	7	—	—			
Elmhurst C	0	8	—	—			
Emory U	2	20	5	14			
Emporia State U	3	7	1	—			
Evansville, U of	1	3	—	—			
Fairfield U	5	0	—	—			
Fairleigh Dickinson U							
Madison	4	0	1	—			
Teaneck	5	2	2	—			
Fisk U	5	4	2	—			
Florida A&M U	1	3	—	—	11	1	2
Florida Atlantic U	6	26	4	—			
Florida Institute of Tech	0	4	0	0	a		
Florida International U	8	22	4	—			
Florida State U	0	22	8	8			
Florida, U of	3	33	4	31	19	2	9
Fordham U	0	9	1	—			
Fort Lewis C	4	11	—	—			
Framingham State C	3	0	—	—			
Franklin & Marshall C	13	2	—	—			
Furman U	17	1	4	—			
Geneva C	1	7	—	—			
George Mason U	12	0	4	—			
George Washington U	6	6	1	0			
Georgetown U	15	0	16	4			
Georgia Institute of Tech	29	0	7	8	59	8	7
Georgia Southern C	2	2	—	—			
Georgia State U	5	4	2	—			
Georgia, U of	1	7	6	11			
Gettysburg C	9	1	—	—			
Glassboro State C	6	1	—	—			
Gonzaga U	5	0	—	—			
Goucher C	0	5	—	—			
Grand Valley State U	0	4	—	—			
Grinnell C	2	9	—	—			
Gustavus Adolphus C	3	11	—	—			
Hamilton C	2	2	—	—			
Hamline U	6	9	—	—			
Hampden-Sydney C	6	3	—	—			
Hampton U	8	0	5	—			
Hartford, U of	0	1	0	—			
Hartwick C	1	2	—	—			
Harvard U	26	0	16	25			
Harvey Mudd C	14	0	—	—			
Haverford C	14	2	—	—			
Hawaii, U of	18	2	3	3			
Hendrix C	9	3	—	—			
Hiram C	5	6	—	—			
Hobart & William Smith C	2	6	—	—			
Hofstra U	4	2	—	—			
Hollins C	0	3	—	—			
Holy Cross, C of the	8	3	—	—			
Hope C	12	10	—	—			
Houston, U of	7	2	8	8	22	10	7
Howard U	4	23	1	5	28	0	—
Humboldt State U	1	4	—	—			
Idaho State U	2	4	0	—			
Idaho, U of	3	8	7	4	20	5	4
Illinois Benedictine C	10	2	—	—			
Illinois Institute of Tech	4	0	3	1	25	11	6
Illinois State U	33	3	5	—			
Illinois Wesleyan U	4	2	—	—			
Illinois, U of							
Chicago	17	34	16	15	20	11	3
Urbana-Champaign	62	76	11	51	72	10	13
Indiana State U	7	1	1	—			
Indiana U							
Bloomington	23	94	5	26			
Northwest	3	3	—	—			
South Bend	5	0	—	—			
Pennsylvania	10	4	6	—			
Indiana U-Purdue U							
Fort Wayne	2	4	—	—			
Indianapolis	1	21	7	—			
Interamerican U of Puerto Rico	3	12	—	—			
Iowa State U	9	2	7	53	39	6	2
Iowa, U of	18	0	10	18	a		
Ithaca C	5	0	—	—			
Jackson State U	4	3	1	—			
James Madison U	2	16	—	—			
John Carroll C	5	24	4	—			
Johns Hopkins U	17	0	12	9	9	2	6
Juniata C	3	5	—	—			
Kalamazoo C	4	4	—	—			
Kansas State U	3	4	2	7	10	3	1
Kansas, U of	7	17	1	4	18	6	3
Kean C of New Jersey	4	11	—	—			
Kennesaw State C	2	4	—	—			
Kent State U	10	3	1	1			
Kentucky, U of	4	12	6	6	20	8	0
Kenyon C	2	5	—	—			
King's C	7	1	—	—			
Knox C	0	14	—	—			
La Salle U	5	2	—	—			
Lafayette C	7	7	—	—	18	—	—
Lake Forest C	2	4	—	—			
Lamar U	4	1	10	—	11	8	0
Lawrence Technological U	6	0	—	—			
Lawrence U	7	6	—	—			
Le Moyne C	3	2	—	—			
Lebanon Valley C	2	1	—	—			
Lehigh U	4	4	6	11	27	11	13
Lewis & Clark C	2	5	—	—			
Lincoln U	1	13	—	—			
Long Island U							
Brooklyn C	3	0	1	—			
C. W. Post C	2	4	—	—			
Loras C	0	1	—	—			
Louisiana State U							
Baton Rouge	5	3	1	19	25	7	6
Shreveport	2	0	—	—			
Louisiana Technological U	3	3	1	—	a		
Louisville, U of	15	0	0	2	—	18	1
Lowell, U of	5	5	8	13	a		
Loyola C in Maryland	0	3	—	—			
Loyola Marymount U	7	0	—	—			
Loyola U							
Chicago	10	4	0	4			
New Orleans	0	6	—	—			
Luther C	1	2	—	—			
Lycoming C	0	3	—	—			
Macalester C	4	10	—	—			
Maine, U of	4	2	1	3	25	1	2
Manhattan C[c]	6	4	—	—	18	8	—
Manhattanville C	0	0	—	—			
Mankato State U	4	10	4	—			
Marietta C	5	2	—	—			
Marist C	1	0	—	—			
Marquette U	6	0	5	7			
Marshall U	1	13	6	—			
Maryland U of							
Baltimore County	2	27	1	1	9	2	0
College Park	5	51	11	28	17	3	3
Massachusetts Institute of Tech	23	0	3	39	40	39	32
Massachusetts, U of							
Amherst	7	8	11	15	33	3	12
Dartmouth	2	7	5	—			
McNeese State U	5	0	4	—			
Memphis State U	1	9	0	1			
Mercer U	1	6	—	—			
Merrimack C	3	4	—	—			
Metropolitan State C	2	17	—	—			
Miami U	20	21	3	10			
Miami, U of	5	13	2	4			
Michigan State U	16	22	6	22	a		
Michigan Technological U	12	0	6	5	45	9	0
Michigan, U of							
Ann Arbor	55	0	32	29	59	9	8
Dearborn	13	12	—	—			
Flint	1	5	—	—			
Middle Tennessee State U	2	10	6	—			
Middlebury C	4	7	—	—			
Midwestern State U	4	5	—	—			
Millersville U	3	5	—	—			
Millsaps C	2	5	—	—			
Minnesota, U of							
Duluth	7	7	5	—			
Minneapolis	43	0	11	28	96	9	28
Mississippi C	2	4	—	—			
Mississippi State U	3	5	1	1	a		
Mississippi, U of	0	7	7	7	2	3	1

	CHEMISTRY				CHEMICAL ENGINEERING		
	Bachelors certified						
	Yes	No	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
Missouri, U of							
Columbia	11	1	10	6	21	4	2
Kansas City	4	21	5	2			
Rolla	5	0	3	7	29	8	3
St. Louis	11	5	1	4			
Missouri Western State C	4	4	—	—			
Monmouth C	2	0	—	—			
Montana C of Mineral Science & Technology	0	1	1	—			
Montana State U	1	3	3	7	21	3	1
Montana, U of	1	7	3	1			
Montclair State C	5	3	2	—			
Moorhead State U	8	4	—	—			
Moravian C	4	0	—	—			
Morehouse C	6	0	—	—			
Morgan State U	6	4	—	—			
Mount Holyoke C	6	8	2	—			
Mount Saint Vincent, C of[c]	1	0	—	—			
Muhlenberg C	2	8	—	—			
Murray State U	4	14	4	—			
Muskingum C	0	2	—	—			
Nazareth C	2	3					
Nebraska Wesleyan U	2	1	—	—			
Nebraska, U of							
Kearney	0	9	—	—			
Lincoln	5	4	9	6	13	5	1
Omaha	1	2	—	—			
Nevada, U of							
Las Vegas	4	6	1	—			
Reno	4	4	2	4	a		
New Hampshire, U of	5	1	5	1	15	1	1
New Jersey Institute of Tech[b]					15	19	6
New Mexico Highlands U	0	1	0	—			
New Mexico Inst. of Mining & Tech	9	0	1	2			
New Mexico State U	1	21	10	8	20	2	1
New Mexico, U of	9	9	4	9	7	8	0
New Orleans, U of	0	3	3	7			
New York U	2	38	25	12			
Niagara U	0	8	—	—			
North Alabama, U of	5	21	—	—			
North Carolina A&T State U	6	0	0	—			
North Carolina Central U	1	4	1	—			
North Carolina State U	32	41	5	10	77	4	7
North Carolina, U of							
Asheville	1	4	—	—			
Chapel Hill[e]	27	44	12	39			
Charlotte	4	10	2	—			
Greensboro	7	6	4	—			
Wilmington	5	9	—	—			
North Dakota State U	0	13	2	5			
North Dakota, U of	2	10	1	1	13	3	—
North Texas, U of	3	7	9	6			
Northeast Louisiana U	0	2	5	—			
Northeast Missouri State U	9	0	—	—			
Northeastern Illinois U	0	19	3	—			
Northeastern U	3	0	6	7	a		
Northern Arizona U	5	22	5	—			
Northern Colorado, U of	1	4	0	0			
Northern Illinois U	9	15	10	11			
Northern Iowa, U of	10	13	0	—			
Northern Kentucky U	2	3	—	—			
Northern Michigan U	1	13	0	—			
Northwest Missouri State U	3	1	—	—			
Northwestern State U of Louisiana	2	0	—	—			
Northwestern U	8	11	25	15	26	10	6
Notre Dame, U of	2	13	8	18	22	7	6
Oakland U	5	2	1	1			
Oberlin C	4	20	—	—			
Occidental C	10	10	—	—			
Ohio Northern U	10	4	—	—			
Ohio State U	31	0	17	47	35	13	4
Ohio U	3	11	6	3	11	2	1
Ohio Wesleyan U	0	7	—	—			
Oklahoma State U	2	3	3	7	16	7	4
Oklahoma, U of	11	10	9	9	23	10	5
Old Dominion U	3	4	5	3			
Oregon State U	12	2	3	13	14	7	0
Oregon, U of	6	22	1	11			
Pace U							
New York	0	0	—	—			
Pleasantville	0	5	—	—			
Pacific Lutheran U	3	4	—	—			
Pacific, U of the	0	8	3	2			
Pennsylvania State U	10	27	4	37	87	14	11
Pennsylvania, U of	6	15	11	17	18	10	8
Philadelphia C of Pharmacy & Science	1	6	0	0			
Philadelphia C of Textiles & Science	2	0	—	—			
Pittsburg State U	1	2	3	—			
Pittsburgh, U of	20	49	2	25	28	10	9
Polytechnic U	2	0	4	14	a		
Pomona C	0	10	—	—			
Portland State U	11	11	0	5			
Portland, U of	0	0	—	—			
Pratt Institute[b]					1	—	—
Princeton U	10	9	0	11	22	2	12
Providence C	1	7	0	0			
Puerto Rico, U of							
Mayaguez	7	9	8	—	68	7	—
Rio Piedras	8	19	3	5			
Puget Sound, U of	5	4	—	—			
Purdue U	12	19	11	37	108	10	20
Purdue U Calumet	3	1	—	—			
Ramapo C of New Jersey	0	5	—	—			
Randolph-Macon C	1	4	—	—			
Randolph-Macon Woman's C	1	2	—	—			
Redlands, U of	1	4	—	—			
Reed C	7	8	—	—			
Rensselaer Polytechnic Inst	22	0	9	13	27	7	9
Rhode Island C	2	5	—	—			
Rhode Island, U of	1	1	3	7	17	8	1
Rhodes C	6	12	—	—			
Rice U	6	8	8	11	12	4	9
Richmond, U of	5	19	—	—			
Rider C	4	0	—	—			
Ripon C	3	1	—	—			
Roanoke C	1	3	—	—			
Rochester Institute of Tech	3	9	8	—			
Rochester, U of	10	5	25	18	21	10	5
Rockhurst C	3	1	—	—			
Rollins C	2	0	—	—			
Roosevelt U	3	0	4	—			
Rose-Hulman Institute of Tech	4	0	—	—	30	0	—
Russell Sage C	1	1	—	—			
Rutgers U							
Camden C of Arts & Science	2	5	—	—			
New Brunswick Dept. of Chemistry	16	25	14	12	28	8	9
Newark College of Arts & Sciences	7	7	6	4			
St. Anselm C	2	2	—	—			
St. Catherine, C of	2	3	—	—			
St. Cloud State U	6	5	—	—			
St. John Fisher C	1	1	—	—			
St. John's U/C of St. Benedict	6	14	—	—			
St. John's U	2	2	1	—			
St. Joseph C	4	2	2	—			
St. Joseph's U	10	6	7	—			
St. Lawrence U	2	4	—	—			
St. Louis U	4	7	8	—			
St. Mary's C	1	5	—	—			
St. Michael's C	0	2	—	—			
St. Olaf C	9	42	—	—			
St. Peter's C	0	3	—	—			
St. Thomas, U of	3	10	—	—			
St. Vincent C[d]	3	5	—	—			
Saginaw Valley State U	2	7	—	—			
Salem State C	3	0	—	—			
Sam Houston State U	2	2	2	—			
San Diego State U	13	0	10	4			
San Francisco State U	2	22	5	—			
San Francisco, U of	1	4	4	—			
San Jose State U	9	20	11	—	a		
Sangamon State U	4	0	—	—			
Santa Clara U	2	4	—	—			
Scranton, U of	3	8	6	—			
Seattle U	0	2	—	—			
Seton Hall U	5	5	11	7			
Seton Hill C[d]	0	1	—	—			
Shippensburg U	4	5	2	—			
Siena C	6	0	—	—			
Simmons C	1	2	—	—			
Skidmore C	0	9	—	—			
Smith C	0	4	—	—			
Sonoma State U	2	11	—	—			

	CHEMISTRY				CHEMICAL ENGINEERING		
	Bachelors certified						
	Yes	No	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
South Alabama, U of[b]					7	2	—
South Carolina, U of	3	16	4	29	30	5	3
South Dakota School of Mines & Tech	3	1	1	—	25	3	—
South Dakota State U	1	30	8	0			
South Dakota, U of	1	3	1	—			
South Florida, U of	15	23	2	3	14	2	2
Southeast Missouri State U	3	4	—	—			
Southeastern Louisiana U	1	0	—	—			
Southern California, U of	9	2	4	22	12	14	7
Southern Colorado U	0	2	0	—			
Southern Illinois U							
Carbondale	10	0	6	4			
Edwardsville	11	12	6	—			
Southern Methodist U	5	7	0	—			
Southern Mississippi, U of	1	24	2	5			
Southern Oregon State C	2	3	—	—			
Southern U and A&M C	3	5	2	—			
Southwest Missouri State U	1	9	—	—			
Southwest State U	3	11	—	—			
Southwest Texas State U	8	0	5	—			
Southwestern Louisiana, U of	0	6	0	—	6	3	—
Southwestern Oklahoma State U	2	10	—	—			
Stanford U	7	6	8	33	21	10	11
State U of New York							
Albany	11	0	1	3			
Binghamton	7	11	1	6			
Buffalo	22	8	3	19	20	9	10
Stony Brook	11	17	9	24			
C at Brockport	3	7	—	—			
C at Buffalo	0	6	1	—			
C at Cortland	0	3	—	—			
C at Fredonia	4	3	0	—			
C at Geneseo	6	4	—	—			
C at New Paltz	1	4	0	—			
C at Oneonta	0	9	—	—			
C at Oswego	13	5	6	—			
C at Plattsburgh	5	5	1	—			
C at Potsdam	4	2	—	—			
C at Purchase	0	4	—	—			
Stephen F. Austin State U	3	5	2	—			
Stetson U	2	5	—	—			
Stevens Institute of Tech	5	0	9	3	9	10	5
Stockton State C	5	6	—	—			
Suffolk U	2	0	—	—			
Susquehanna U	2	4	—	—			
Swarthmore C	6	4	—	—			
Syracuse U	3	5	3	8	11	10	7
Temple U	9	0	2	3			
Tennessee Technological U	4	5	2	—	15	1	0
Tennessee, U of							
Chattanooga	10	14	—	—			
Knoxville	2	10	6	13	27	8	6
Martin	1	9	—	—			
Texas A&I U	6	0	0	—	a		
Texas A&M U	21	15	7	39	61	16	14
Texas Christian U	4	5	1	2			
Texas Southern U	4	0	8	—			
Texas Tech U	20	8	5	8	a		
Texas Woman's U	1	8	0	—			
Texas, U of							
Arlington	4	17	8	7			
Austin	69	0	12	42	70	18	29
Dallas	5	0	4	3			
El Paso	6	0	5	—			
Thiel C	1	1	—	—			
Thomas More C	4	0	—	—			
Toledo, U of	2	4	6	2	10	4	1
Towson State U	4	8	—	—			
Trenton State C	7	0	—	—			
Tri-State U[b]					6	—	—
Trinity C	4	0	0	—			
Trinity U	7	4	—	—			
Tufts U	0	12	8	9	18	8	4
Tulane U	1	13	1	3	a		
Tulsa, U of	9	0	—	—	a		
Tuskegee U	0	4	0	—	a		
Union C	3	4	—	—			
U.S. Air Force Academy	18	0	—	—			
U.S. Naval Academy	14	0	—	—			
Ursinus C	6	8	—	—			
Utah State U	10	0	2	1			
Utah, U of	3	33	6	20	13	5	3
Valparaiso U	2	25	—	—			
Vanderbilt U	2	26	7	7	12	6	2
Vassar C	1	4	0	—			
Vermont, U of	7	0	2	4			
Villanova U	10	0	7	2	14	5	—
Virginia Commonwealth U	5	19	1	8			
Virginia Military Institute	2	0	—	—			
Virginia Poly Institute & State U	9	12	14	14	43	4	3
Virginia, U of	9	66	3	16	16	16	8
Wabash C	8	12	—	—			
Wagner C	1	0	—	—			
Wake Forest U	8	15	1	0			
Washburn U	2	4	—	—			
Washington C	1	0	—	—			
Washington State U	5	3	2	3	19	7	5
Washington U	8	5	10	12	15	12	3
Washington, U of	34	19	17	36	52	4	14
Washington & Jefferson C	3	10	—	—			
Washington & Lee U	0	7	—	—			
Wayne State U	15	16	6	16	12	8	3
Waynesburg C	6	0	—	—			
Weber State C	7	3	—	—			
Wellesley C	2	20	—	—			
Wesleyan U	1	7	0	3			
West Chester U	5	14	6	—			
West Florida, U of	10	3	—	—			
West Virginia Institute of Tech[b]					5	4	0
West Virginia State C	0	4	—	—			
West Virginia U	4	14	2	3	10	6	3
Western Illinois U	0	8	1	—			
Western Kentucky U	2	29	4	—			
Western Maryland C	0	2	—	—			
Western Michigan U	2	16	0	1			
Western New England C	0	0	—	—			
Western Washington U	4	7	4	—			
Westminster C	0	2	—	—			
Wheaton C							
Illinois	5	8	—	—			
Massachusetts	0	1	—	—			
Whitman C	1	5	—	—			
Whittier C	0	3	—	—			
Wichita State U	8	13	4	3			
Widener U	0	1	—	—	11	—	—
Wilkes U	0	2	—	—			
Willamette U	2	11	—	—			
William Paterson C of N.J.	0	4	—	—			
William and Mary, C of	41	5	4	—			
Williams C	1	22	—	—			
Winona State U	2	0	—	—			
Wisconsin, U of							
Eau Claire	9	6	—	—			
Green Bay	1	9	—	—			
LaCrosse	4	12	—	—			
Madison	27	6	9	29	72	12	16
Milwaukee	1	14	7	3			
Oshkosh	5	3	—	—			
Parkside	2	7	—	—			
Platteville	0	5	—	—			
River Falls	10	10	—	—			
Stevens Point	8	7	—	—			
Superior	2	0	—	—			
Wittenberg U	3	6	—	—			
Wooster, C of	6	14	—	—			
Worcester Polytechnic Institute	0	4	1	0	33	3	3
Wright State U	14	6	10	—			
Wyoming, U of	6	3	2	7	6	3	1
Xavier U	3	4	—	—			
Xavier U of Louisiana	4	31	—	—			
Yale U	0	16	13	21	a		
Youngstown State U	4	26	0	—	21	—	—
TOTALS	3310	4562	1600	2213	3081	816	602

Note: For brevity, "B.S." and "M.S." are used to denote all bachelor's and master's degrees, respectively, in each column. **a** Data not submitted. **b** Listed on basis of accreditation by AIChE-ABET. **c** The chemistry programs at Mount Saint Vincent and Manhattan College are integrated into a combined department with instruction in chemistry located at Manhattan College. **d** Saint Vincent College and Seton Hill College are integrated into a combined department. **e** UNC, Chapel Hill, Applied Curriculum in Chemistry degrees are combined with the chemistry department degrees.

Illinois, Berkeley top producers of chemists

The University of Illinois, Urbana-Champaign; Cornell University; and the University of California, Berkeley, were, in that order, the largest producers of new bachelor's, master's, and Ph.D. chemists in the 1990–91 academic year.

Last year also saw the stemming of a seven-year decline in the total number of new bachelor's degree chemists with 7872 such graduates, up almost 3% from 7650 in 1989–90. As recently as 1984–85, however, there were 9679 new bachelor's degree chemists.

These are some of the salient points contained in the latest report of ACS's Committee on Professional Training. This committee gathers graduation data annually from chemistry departments with undergraduate programs it has approved. These departments account for about 95% of all new bachelor's degree chemists and for essentially all advanced chemistry degrees.

Indiana University, Bloomington, the largest producer of bachelor-level chemists in the previous six years, dropped to second in 1990–91, behind Illinois. The University of California, Los Angeles, hung onto the third spot.

Cornell University was the largest producer of master's chemistry graduates in both 1989–90 and 1990–91. The University of Michigan, Ann Arbor, moved to second last year from ninth a year earlier.

Last year was the seventh year in a row that Berkeley headed the list of Ph.D. producers. Iowa State was a strong second, moving up from seventh place.

The University of Texas, Austin, and Urbana-Champaign last year retained their number one and two spots as the largest producers of certified bachelor's graduates. These graduates are immediately eligible for ACS membership.

Five schools appear on the lists of top producers of bachelor's, certified bachelor's, master's, and doctoral chemists. They are the University of California, San Diego; University of Michigan, Ann Arbor; University of North Carolina, Chapel Hill; University of Texas, Austin; and the University of Washington.

Michael Heylin

These schools had the most chemistry graduates, 1990-91

Total bachelor graduates

1.	U of Illinois, Urbana-Champaign	138
2.	Indiana U, Bloomington	117
3.	U of California, Los Angeles	103
4.	U of Virginia	75
5.	North Carolina State U	73
6.	U of North Carolina, Chapel Hill	71
7.	U of Pittsburgh	69
7.	U of Texas, Austin	69
9.	U of California, San Diego	56
9.	U of Maryland, College Park	56
11.	U of Michigan, Ann Arbor	55
12.	U of California, Berkeley	54
13.	U of Washington	53
14.	U of Illinois, Chicago	51
14.	St. Olaf C	51
16.	U of Colorado, Boulder	48
17.	C of William & Mary	46
18.	Cornell U	45
19.	U of Minnesota, Minneapolis	43
20.	U of California, Davis	42
21.	U of Delaware	41
21.	Miami U	41
21.	Rutgers U, New Brunswick	41
24.	New York U	40
25	Michigan State U	38
25.	U of South Florida	38

Certified bachelor graduates

1.	U of Texas, Austin	69
2.	U of Illinois, Urbana-Champaign	62
3.	U of California, San Diego	56
4.	U of Michigan, Ann Arbor	55
5.	U of Minnesota, Minneapolis	43
6.	C of William & Mary	41
7.	U of Washington	34
8.	U of California, Davis	33
8.	Illinois State U	33
10.	North Carolina State U	32
11.	Ohio State U	31
12.	Georgia Inst of Tech	29
13.	U of California, Berkeley	28
14.	U of North Carolina, Chapel Hill	27
14.	U of Wisconsin, Madison	27
16.	U of Delaware	26
16.	Harvard U	26
16.	Youngstown State U	26
19.	Indiana U, Bloomington	23
19.	Massachusetts Inst of Tech	23
21.	U of Akron	22
21.	Rensselaer Polytechnic Inst	22
21.	State U of New York, Buffalo	22
24.	U of Cincinnati	21
24.	Texas A&M U	21

Master graduates

1.	Cornell U	33
2.	U of Michigan, Ann Arbor	32
3.	New York U	25
3.	Northwestern U	25
3.	U of Rochester	25
6.	U of Cincinnati	19
6.	City U New York, City C	19
8.	U of California, Irvine	17
8.	Ohio State U	17
8.	U of Washington	17
11.	Columbia U	16
11.	Georgetown U	16
11.	Harvard U	16
11.	U of Illinois, Chicago	16
15.	U of California, Los Angeles	15
15.	U of California, San Diego	15
17.	Rutgers U, New Brunswick	14
17	Virginia Poly Inst & State U	14
19.	California State U, Long Beach	13
19.	U of Chicago	13
19.	Clarkson U	13
19.	Yale U	13
23.	Johns Hopkins U	12
23.	U of North Carolina, Chapel Hill	12
23.	U of Texas, Austin	12

Doctoral graduates

1.	U of California, Berkeley	55
2.	Iowa State U	53
3.	U of Illinois, Urbana-Champaign	51
4.	Ohio State U	47
5.	City U New York, Graduate Center	42
5.	U of Texas, Austin	42
7.	Massachusetts Inst of Tech	39
7.	U of North Carolina, Chapel Hill	39
7.	Texas A&M U	39
10.	U of California, Los Angeles	37
10.	Pennsylvania State U	37
10.	Purdue U	37
13.	U of Washington	36
14.	Stanford U	33
15.	U of California, Davis	31
15.	U of Florida	31
17.	U of Cincinnati	29
17.	U of Michigan, Ann Arbor	29
17.	U of South Carolina	29
17.	U of Wisconsin, Madison	29
21.	U of Arizona	28
21.	U of Maryland, College Park	28
21.	U of Minnesota, Minneapolis	28
24.	U of California, San Diego	26
24.	Indiana U, Bloomington	26